Before the

FEDERAL COMMUNICATIONS COMMISSION

WASHINGTON, D.C. 20554

In the Matter of	)	
	)	
Flexibility for Delivery	)	IB Docket No. 01-185
of Communications by	)	
Mobile Satellite Service Providers	)	
in the 2 GHz and, the L-Band, and the	)	
1.6/2.4 GHz Band	)	

REPLY COMMENTS OF INMARSAT VENTURES PLC

INMARSAT VENTURES PLC

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EXECUTIVE SUMMARY

Inmarsat, as a global provider of mobile satellite services in the L-Band, has a particular interest in ensuring that the safety and commercial services currently provided in the L-Band remain free from interference. Many users of the L-Band have echoed the need to protect these essential services from interference and they oppose any proposal to allow ancillary terrestrial services at L-Band. While Motient has incorrectly asserted that terrestrial use of the L-Band should be permitted because it will not harm anyone else, no analysis is presented by *any party* to support this proposition.

To the contrary, any ancillary terrestrial component ("ATC") use of the L-Band would (i) violate the United States' obligations under the ITU Radio Regulations and under the Mexico City MOU; (ii) create unacceptable interference to Inmarsat's satellite network; and (iii) exacerbate spectrum scarcity problems in the L-Band. In particular, the terrestrial system proposed by Motient would harm Inmarsat's operations and undermine the vital distress and safety services that Inmarsat provides to ships and airplanes as well as the commercial services that Inmarsat provides.

As the Commission is aware, unlike the 2GHz and Big LEO Bands, use of the L-Band is governed not only by the ITU Table of Frequency Allocations, but also by the Mexico City MOU, an international agreement between the United States and four other countries. The MOU governs the use of the L-Band over North America, and simply does not allow any party to use the L-Band for terrestrial purposes. Moreover, the ITU Table of Frequency Allocations does not provide for terrestrial uses of the L-Band in North America, and any terrestrial uses in derogation of the ITU Table may be authorized only if they can operate on a non-interference basis. As detailed in Inmarsat's Comments and herein, the terrestrial uses proposed by Motient would cause unacceptable interference into the Inmarsat MSS system. For these reasons,

flexible use of the L-Band may not be authorized under Section 303(y) of the Communications Act.

Many commenters support the concept of ATC only as long as existing services can be fully protected from interference. Inmarsat has demonstrated that Motient's proposed terrestrial component would cause unacceptable interference into Inmarsat's satellites and Inmarsat's mobile earth terminals. In addition, terrestrial use of the Big LEO band also would present an interference threat into Inmarsat's mobile earth terminals. These interference problems are so significant that Boeing has urged the Commission not to allow terrestrial uses in *any MSS downlink band.*

Motient for the first time has also acknowledged that its proposed terrestrial handsets could cause interference into the Inmarsat system, if the signals from those transmitters were not sufficiently shielded by buildings and other obstacles. There are two main problems with relying on shielding to resolve this interference problem: (i) there are many circumstances where the signals from Motient's terrestrial handsets will not actually be blocked in urban and suburban areas, and (ii) real world measurements demonstrate that the average level of shielding in urban and suburban areas is inadequate to render harmless the interfering signals from the Motient terrestrial handsets.

Recognizing that its terrestrial proposal presents a potential interference problem, Motient has proposed an interference monitoring plan. That plan is neither sufficient nor realistically implementable. Motient asserts that it will be able to monitor its terrestrial-based interference at its satellite and that it would adjust its terrestrial service if the terrestrial interference exceeded a baseline interference level. As an initial matter, Motient incorrectly assumes that Inmarsat is required under ITU Rules to accept a baseline level of interference from Motient's proposed terrestrial terminals – Inmarsat is not required to do so. In any event,

Motient would not be able to use its spacecraft to accurately measure the interference caused to Inmarsat's system. Among other things, there are many circumstances where the path to Motient's satellites would be blocked, but the path to Inmarsat's satellites would not be blocked. Moreover, once its service is rolled out at a cost of hundreds of millions of dollars, it is not reasonable to assume that Motient will simply cease the service when interference issues arise. Nor is it reasonable for Motient, Inmarsat's competitor, to measure and determine the extent of Motient's own interference into the Inmarsat system.

Similarly, the technical standards that Motient proposes for its terrestrial transmitters would be inadequate to protect Inmarsat's existing service. Motient's rules may be appropriate for purposes of protecting terrestrial users in bands adjacent to the L-Band, but they will not prevent Motient's terrestrial transmitters from overloading Inmarsat's mobile terminals, which have not been designed to operate in the same band as terrestrial transmitters.

Although many commenters have acknowledged how essential it is that any authorized ATC actually remain ancillary, no commenter has proposed a feasible means of ensuring that terrestrial uses do not eclipse the satellite uses of the L-Band over time. By Motient's own description, its proposed terrestrial use would increase Motient's spectrum needs, thereby worsening the current spectrum scarcity problems in the L-Band.

In order to prevent the interference, safety and legal problems that would arise from terrestrial use of the L-Band, Motient's need to expand its service to urban and suburban areas should be addressed through the use of existing technology – dual-band handsets, and commercial arrangements with cellular or PCS providers. Inmarsat urges the Commission to maintain the use of the L-Band solely for satellite uses.

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REPLY COMMENTS OF INMARSAT VENTURES PLC

Inmarsat Ventures plc ("Inmarsat") hereby submits its reply comments in support of retaining the L-Band[1] solely for satellite-based services and in opposition to Motient Services, Inc.'s ("Motient's") application to integrate terrestrial components into its MSS satellite network,[2] and in opposition to any other attempt to allow terrestrial use of the L-Band in the United States. A variety of companies, organizations, and individuals have filed comments in this proceeding, most of which have been directed at flexibility in the 2 GHz band and the 1.6/2.4 GHz ("Big LEO") band. As an owner and operator of a geostationary orbit MSS system that operates across the L-Band around the world, Inmarsat's comments continue to focus on the unique and particularly problematic frequency interference, safety and legal issues that arise from the proposed use of the L-Band for terrestrial purposes.

As discussed below and in Inmarsat's Comments, authorizing terrestrial uses in the L-Band would (i) create unacceptable inference to Inmarsat's satellite network, including

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1 L-Band refers to the frequencies allocated for MSS and aeronautical mobile-satellite (R) service at 1525-1559 MHz and 1626.5-1660.5 MHz.

2 *See In the Matter of Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Band, Notice of Proposed Rule Making*, IB Docket No. 01-185 and ET Docket No. 95-18 (rel. August 17, 2001) (the "*Flexibility NPRM*").

vital safety services provided in the L-Band; (ii) violate the United States' obligations under the ITU Radio Regulations and under a separate international coordination agreement that governs use of the L-Band over North America, to which the United States is a party; and (iii) exacerbate existing spectrum scarcity problems in the L-Band. Therefore, flexible terrestrial uses cannot be authorized under Section 303(y) of the Communications Act. The approaches suggested by Motient and other commenters to attempt to solve the interference threat posed by terrestrial services in the L-Band are neither technically sufficient, nor practically implementable. Alternative methods of integrating L-Band MSS satellite service and terrestrial services, such as dual-band handsets, however, provide a means of solving Motient's operational issues without creating a serious interference threat to the MSS services provided over the Inmarsat system.

I. L-BAND SERVICES AND INTERFERENCE ISSUES ARE UNIQUE

A. The Inmarsat System Provides Vital Services at L-Band

Inmarsat offers a wide range of mobile satellite communications solutions to customers at sea, on land and in the air.[3] Through its global satellite system, Inmarsat provides communications services to users such as the U.S. Navy, U.S. Coast Guard and commercial vessels at sea, CNN and the International Red Cross on land, and almost every major airline in the air. Inmarsat's satellite services include telephony, data, e-mail, fax, digitally compressed video, and Internet access to end users where no terrestrially-based communication service will reach.

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[3] *See* Comments of Inmarsat Ventures plc at 2-9, IB Docket No. 01-185 (filed Oct. 22, 2001) ("Inmarsat Comments").

As discussed in greater detail below, and as noted in the Comments of other parties,[4] any proposal to implement terrestrial services in the L-Band threatens the vital role that the Inmarsat system plays in facilitating emergency services where satellite services are the only practical method of communication. The role of the Inmarsat system in providing essential safety services in general,[5] and in supporting the Global Maritime Distress and Safety System ("GMDSS") in particular, is so critical that Congress mandated in the Orbit Act that "[t]he United States shall seek to preserve space segment capacity of the GMDSS."[6] The aviation industry, in its comments, has similarly recognized the critical role that Inmarsat provides for aeronautical safety services, such as air traffic management and air traffic operational control.[7]

Many commenters supply anecdotes about the essential role that MSS systems provide when terrestrial services fail. For example, Stratos recounts how, in the aftermath of the terrorist attacks on September 11th, Inmarsat MSS mobile earth stations ("MESs") were rushed to assist the U.S. government and United Nation officials in their handling of the emergency.[8] Where the destruction of local central offices and cell sites crippled terrestrial-based

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4 *See, e.g.,* Comments of Stratos Mobile Networks (USA) LLC and Marinesat Communications Network, Inc. at 5, IB Docket No. 01-185, ET Docket No. 95-18 (filed Oct. 22, 2001) ("Stratos Comments") ("the Commission must be wary of any proposal which threatens MSS – the very heart of safety at sea.").

5 *See, e.g.,* Comments of New ICO Global Communications at footnotes 20 & 23, IB Docket No. 01-185, ET Docket No. 95-18 (filed Oct. 22, 2001).

6 47 U.S.C. § 763(c)(3) (2000).

7 *See* Comments of the Aviation Industry Parties at 3-5, IB Docket No. 01-185, ET Docket No. 95-18 (filed Oct. 19, 2001) ("ARINC Comments") ("Aviation will be making increased demands on the INMARSAT system and the upper L-band spectrum for safety communications"); *see also* Comments of the Aerospace and Flight Test Radio Coordination Council at 6, IB Docket No. 01-185, ET Docket No. 95-18 (filed Oct. 22, 2001) ("AFTRCC Comments").

8 *See, e.g.,* Stratos Comments at 6.

communications, MSS providers were able to provide vital communications support to rescue workers and government agencies.

Since September 11th, U.S. Navy and U.S. Coast Guard activity has increased both at home and overseas, and Inmarsat is pleased that both of those branches of the U.S. military rely on the Inmarsat system. In these times of heightened alert and expanded deployment of security forces, it is especially important that communications systems, such as Inmarsat's, remain free from interference so they can reliably provide these types of vital services.

The need for interference-free communications is just as critical to the aviation industry, as it seeks to improve cockpit safety. As noted before, the global Inmarsat system provides priority instant distress and safety communications, and offers a lifeline communications link when airplanes are flying over the oceans. Therefore, it is vital that L-Band satellite systems be fully protected from unacceptable interference, and that the Commission not authorize ancillary terrestrial uses of the L-Band.

B. Terrestrial L-Band Uses Are Precluded By Existing United States International Obligations

1. The Mexico City MOU

Unlike the situation in the 2 GHz and Big LEO bands, in the case of the L-Band, the United States' international obligations arise not only under the Table of Frequency Allocations of the International Telecommunication Union ("ITU"), but also from a multilateral memorandum of understanding with regard to the use of L-Band spectrum over North America.[9] As discussed in Inmarsat's Comments, the MOU governs the use of the L-Band over North

America and establishes procedures that satellite operators must follow in coordinating current and planned uses of the L-Band spectrum.[10]

Motient correctly recognizes that the provisions of the MOU prohibit terrestrial communications providers from using the L-Band for terrestrial services,[11] but Motient ignores the fact *that this same restriction applies to Motient's terrestrial proposal as well.* Terrestrial use of the L-Band is inconsistent with the United States' obligations under the Mexico City MOU. The signatories to the MOU agreed to the coordination process based solely on the use of the L-Band for MSS purposes and no terrestrial uses are provided for in the MOU.[12] In sum, the MOU does not provide for terrestrial use of the L-Band, whether the provider is Motient or any other entity.

2. Section 303(y) Does Not Permit Flexible Use Of The L-Band

The Commission seeks comment on whether flexible use of MSS spectrum is consistent with the requirements of Section 303(y) of the Communications Act.[13] Motient is incorrect in its assertion that an ancillary terrestrial component ("ATC") using L-Band spectrum

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9 *See Flexibility NPRM* at ¶ 49; *See International Action: "FCC Hails Historic Agreement on International Satellite Coordination, News Release,"* Report No. IN 96-16 (June 25, 1996) (the "MOU" or "Mexico City MOU").

10 *See* Inmarsat Comments at 21-25.

11 Comments of Motient Services, Inc., TMI Communications and Company, Limited Partnership, and Mobile Satellite Ventures Subsidiary LLC at 34, IB Docket No. 01-185, ET Docket No. 95-18 (filed Oct. 22, 2001) ("Motient Comments").

12 Nor can the Commission adopt Constellation's proposal that ancillary terrestrial coordination procedures be developed for the L-Band. *See* Comments of Constellation Communications Holdings, Inc. at 32, IB Docket No. 01-185, ET Docket No. 95-18 (filed Oct. 22, 2001) ("Constellation Comments"). The Mexico City MOU has already established coordination procedures for the L-Band, which the United States is obligated to follow. Any changes in those procedures would need to be agreed to by the signatories to the MOU.

13 *Flexibility NPRM* at ¶ 25.

is consistent with Section 303(y).[14] Under Section 303(y), the Commission is authorized to employ flexibility in the use of spectrum where such use is consistent with its international agreements and where such flexibility would not result in harmful interference among users.[15] Neither criteria is met with respect to the L-Band.

As discussed herein and in Inmarsat's comments,[16] use of the L-Band for terrestrial service would violate the United States' international obligations under the MOU and also under the ITU Table of Frequency Allocations.[17] The ITU Table provides solely for satellite use of the L-Band in North America in the bands 1535 – 1559 MHz and 1626.5 – 1660 MHz, while the band 1525 – 1535 MHz is shared with mobile aeronautical telemetry operating on a secondary basis and the band 1660 – 1660.5 MHz is shared with radio astronomy.

Motient itself recognizes that the Commission cannot permit a use of L-Band frequencies in derogation of the ITU Table of Frequency Allocations, unless that use can be made on a non-interference basis.[18] As discussed in Inmarsat's Comments[19] and below,

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14 *See* Motient Comments at 21.

15 47 U.S.C. § 303(y).

16 *See* Inmarsat Comments at 18-26.

17 *See* ITU Radio Reg. Art. 5. Celsat argues that International Mobile Telecommunications-2000 ("IMT-2000") supports terrestrial uses of the satellite bands. Consolidated Comments of Celsat America, Inc. at 3-7, IB Docket No. 01-185, ET Docket No. 95-18 (filed Oct. 22, 2001). While some bands have been identified for both terrestrial and satellite use under IMT-2000, ITU studies, to date, have shown that the satellite and terrestrial components of IMT-2000 cannot share the same frequencies. *See* ITU-R Recommendation M.1036-1. This fact has also been recognized in licensing decisions for terrestrial IMT-2000 in Europe, where licenses have only been awarded in bands not allocated to MSS.

18 Motient acknowledges that "[t]he United States is obligated by treaty to assign spectrum in a manner that is either consistent with this international allocation or does not cause harmful interference to other users." Motient Comments at 35.

19 *See* Inmarsat Comments at 12-16 & Technical Annex.

however, Motient's proposed terrestrial service would cause interference to Inmarsat's satellite network both inside and outside the United States, and there is no way to monitor or control that interference. Thus, flexible use of the L-Band cannot be authorized under Section 303(y), because allowing terrestrial uses would be inconsistent with existing United States international obligations and would result in unacceptable interference into Inmarsat's satellite network.

II. TERRESTRIAL USE OF THE L-BAND WOULD CAUSE UNACCEPTABLE INTERFERENCE INTO THE INMARSAT SYSTEM

A. Commenters Raise Significant Concerns Regarding L-Band Interference

A wide range of satellite service providers and users express serious concerns about the adverse effects on their businesses that would occur if terrestrial-based services were permitted to operate in the L-Band. These satellite service providers and users have raised concerns about interference into essential safety services (domestic and offshore aircraft communications)[20] as well as communications and data services that countless businesses rely upon.[21] Such interference would affect the operations of service providers and users both inside and outside the United States. More generally, numerous commenters, including satellite system operators, have correctly noted that existing satellite systems must be fully protected from any

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20 *See* ARINC Comments at 3-4 ("The proposal for flexible use of L-band threatens the continued availability of MSS spectrum for aviation safety applications."); *see also* AFTRCC Comments at 4 & 6 ("The potential for interference to flight test operations from terrestrial transmitters in the L-band is significantly greater than the proposed DARS repeaters inasmuch as the 1525-1559 MHz MSS band is immediately adjacent to the 1425-1525 MHz flight test band.").

21 *See, e.g.,* Stratos Comments at 9; Comments of Telenor Broadband Services AS at 6-7, IB Docket No. 01-185, ET Docket No. 95-18 (filed October 19, 2001); Comments of Comtech Mobile Datacom Corporation at 2-3, IB Docket No. 01-185, ET Docket No. 95-18 (filed October 19, 2001) ("Comtech Comments"); *see also* Comments of Kitcomm Satellite Communications Ltd. at 3, IB Docket No. 01-185, ET Docket No. 95-18 (filed October 22, 2001) ("ATCs have the potential to create a blanket of interference over significant portions of the U.S. landmass and population.").

interference that could be caused by use of any MSS spectrum for terrestrial purposes.[22] For these reasons, existing operators, including Inmarsat, must be protected from interference even if this means that no terrestrial service is authorized in the L-Band.

As a general matter, no analysis is presented by *any party* to support Motient's assertion that terrestrial use of the L-Band should be permitted because it will not harm anyone else.[23] To the contrary, Boeing has generally confirmed Inmarsat's views with respect to a number of the interference problems that will result from the use of ATCs.[24] Boeing urges the Commission not to allow any ATC base stations whatsoever in the MSS downlink bands due to the significant interference threat from out-of-band emissions presented into the operations of mobile satellite terminals.[25] Boeing's analysis, however, does not consider the interference potential of ATCs into the operations of MSS satellite network systems outside the United

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22 *See, e.g.,* Comments of the Boeing Company at 12-13, IB Docket No. 01-185, ET Docket No. 95-18 (filed October 19, 2001) ("Boeing Comments") ("regardless of any potential changes in the licensing and allocation rules, 2 GHz MSS operators must remain protected from harmful interference"); Comments of the American Petroleum Institute at ii, IB Docket No. 01-185, ET Docket No. 95-18 (filed Oct. 19, 2001) (ATCs should not be allowed to cause harmful interference to or otherwise disrupt incumbent licensee operations); Comments of TMI Communications and Company, Ltd. at 2-3, IB Docket No. 01-185, ET Docket No. 95-18 (filed October 22, 2001) ("TMI Comments") (recognizing the need to protect other operators from interference); Comtech Comments at 2-4 (ancillary terrestrial use of L-Band spectrum should be "permitted only on a non-interfering basis to primary satellite-based operations").

23 While Constellation broadly asserts that ATCs should be permitted as long as they do not harm any other user of the MSS spectrum, Constellation does not provide any supporting analysis that no such harm would occur. *See* Constellation Comments at 13 & note 21.

24 *See* Inmarsat Comments at 12-16 & Technical Annex; Boeing Comments at 12-13 and Appendix A; *see also* Comments of the Wireless Communications Division of the Telecommunications Industry Association at 4-5, IB Docket No. 01-185, ET Docket No. 95-18 (filed Oct. 22, 2001) ("WCD Comments").

25 Boeing's technical analysis confirms that "an ancillary terrestrial service in the downlink band cannot be accommodated because of harmful, unresolvable interference to any MSS licensee in an adjacent band." Boeing Comments at 12 & Appendix A.

States, nor does Boeing address degradation of Motient's spectrum efficiency caused by Motient's intra-system interference. Those issues are analyzed in the Technical Annex to Inmarsat's Comments.

Motient itself admits for the first time that preventative measures would need to be put in place to control interference to L-Band satellite systems if Motient were permitted to provide terrestrial services in that band.[26] As set forth below, the measures that Motient suggests would be wholly inadequate to solve this interference problem.

A more fundamental shortcoming in Motient's comments, however, is its continued failure to provide a sufficiently complete description of its proposed frequency plan and its intended terrestrial network to allow a precise quantification of the interference threat that its system poses. This lack of technical information has concerned not only Inmarsat but other commenters as well.[27] Even though the upper limits of this interference problem have not yet been quantified, the limited information that Motient has provided confirms that even a limited deployment of Motient's proposed terrestrial system would present a significant interference threat to Inmarsat's satellite services.

B. Terrestrial Interference Would Adversely Affect Inmarsat's Operations In Uplink Bands

As Inmarsat has shown in its own Comments, even a small number of terrestrial mobile handsets transmitting interfering signals would cause impermissible interference into Inmarsat's spacecraft.[28] On a basic level, it is important to recognize that a mobile

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26 *See* Motient Comments, Technical Appendix at 3.

27 *See, e.g.,* Comments of Wireless Communications Association International, Inc. at 2-3, IB Docket No. 01-185, ET Docket No. 95-18 (filed Oct. 22, 2001) ("WCA Comments"); WCD Comments at 6.

28 *See* Inmarsat Comments, Technical Annex at Section 3.1.

communications service using a satellite system is very different from a service using a terrestrial component, even if that terrestrial component is used as an "ancillary" supplement to a satellite system. The number of mobile handsets that a satellite-based system can support in a geographic area is capped by the frequency plan and spot beam design of the satellite system. If allowed to add a terrestrial component, however, Motient would be able to deploy a series of terrestrial base stations that would result in a significant increase in the number of mobile handsets it could support in urban and suburban areas.[29]

The marked increase in the number of mobile handsets that would result from the proposed terrestrial service would, correspondingly, increase the number of signals interfering with Inmarsat and other MSS systems in the L-Band. Terrestrial mobile handsets, especially in these large numbers, were not contemplated by the signatories to the Mexico City MOU during negotiations, or in the subsequent annual coordination agreements. MSS operators, including Inmarsat, have invested billions of dollars based on the understanding that use of the L-Band in North America would be limited solely to satellite-based MSS services. In sum, the interference threats here are fundamentally different from those that Motient and Inmarsat have agreed to coordinate.

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[29] *See Consolidated Opposition To Petitions To Deny And Reply To Comments of Motient Services, Inc., et al.* at 3, File No. SAT-ASG-20010302-00017, et al. (filed May 7, 2001) ("*Motient Consolidated Opposition*") (stating that Motient will not be viable unless it gains access to urban markets); *Mobile Satellite Ventures Subsidiary LLC Application for Assignment and Modification of Licenses and for Authority to Launch and Operate a Next-Generation Mobile Satellite System, et al.*, at 13, File No. SAT-ASG-20010302-00017, et al. (filed March 1, 2001) (the "*Application*") (addition of a terrestrial component will "mean that the new system can be marketed to millions of consumers in both rural and urban areas"); *see also* Comments of Globalstar, L.P. and L/Q Licensee, Inc. at 19, IB Docket No. 01-185, ET Docket No. 95-18 (filed Oct. 22, 2001) ("Globalstar Comments") ("ATC authority necessarily will increase substantially the number of Globalstar subscribers.").

While its proposed terrestrial system may enable Motient to solve its current business difficulties, that solution would come at the expense of the traditional and essential MSS services provided by Inmarsat (e.g. maritime and aeronautical safety services, commercial services to airplane and rural communication/data services).

1. Motient Cannot Guarantee That Signals From Its Terrestrial Handsets Will Be Blocked

Motient has admitted that its proposed mobile handsets would generate signals that could interfere with the Inmarsat system if they were not blocked by buildings or other obstacles. But Motient has claimed that its proposed terrestrial uses will not actually cause interference problems because, Motient asserts, the mobile handsets will be used in urban areas where the signals are likely to be blocked in the direction of the Inmarsat satellites. In essence, Motient has asked the Commission and Inmarsat to gain comfort that there is no real interference problem because of the expected blockage of the Motient terrestrial signals.

There is, of course, no way that Motient can guarantee that its proposed terrestrial mobile handsets will be used solely where the signals will be blocked, especially in light of the disclosure in its Comments that base stations and handsets will be deployed more broadly, and will be used in suburban regions as well as urban areas.[30] Moreover, Inmarsat's Supplemental Technical Annex demonstrates why, even in urban and suburban areas, Motient cannot rely on nearby structures as a means to block the signals of its terrestrial mobile handset signals being emitted in the direction of the Inmarsat spacecraft, and thereby hope to prevent interference from occurring into the Inmarsat system.[31]

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30 *See* Motient Comments, Technical Appendix at 4 ("Operation of L-band terrestrial base stations in some suburban areas may be needed in order to provide in-building penetration in those areas.")

31 *See* Supplemental Technical Annex at Sections 1.1 & 2.

Even in dense urban areas, neither Motient, the Commission, nor Inmarsat can be assured that Motient's proposed terrestrial signals will be attenuated sufficiently to foreclose interference. As many commenters, including Motient, noted, mobile satellite terminals were successfully used in New York City following the September 11th attacks to maintain government and rescue communications.[32] Even in part of the densest urban center in the United States, mobile terminals were able to send to and receive signals from spacecraft. If Motient were allowed to operate terrestrial-based services in New York and other cities, there undoubtedly would be urban areas from which Motient's terrestrial signals would likewise be able to reach Inmarsat's satellites. As a result, Inmarsat satellites would suffer interference and Inmarsat's services would be adversely affected both inside the U.S. and abroad.

2. Shielding Effects Will Not Protect Inmarsat From Interference

Motient's claim that its terrestrial transmitters will not cause interference into the Inmarsat network is *entirely contingent* on its assumptions about "typically" expected levels of attenuation of the Motient signals. As demonstrated more fully below and in the Supplemental Technical Annex, these assumptions are both fundamentally flawed and stretch the certain predictive models on which Motient relies way out of context.[33] Thus, there is no basis on which to conclude that Inmarsat will be protected from interference by shielding or other signal attenuation effects.

At its most basic level, there is a critical difference between the path attenuation assumptions that one reasonably would make when trying to make a *wanted* signal perform

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32 *See* Motient Comments at 9-10.

33 *See* Supplemental Technical Annex at Section 3.

satisfactorily, and the path attenuation assumptions that one can make in a case such as this one where the issue is preventing an *unwanted* signal from harming a satellite network.

When designing a communications link, one strives to ensure reliable signal reception for a large percentage of the time. The natural inclination is to design the system conservatively. That is, within reason (i.e., system costs), it is better to assume too much path attenuation, and design the system to transmit at a higher level of power, than to guess wrong, experience too much path attenuation in the real world, and not have the system work. When trying to make a wanted link perform, it is useful to know, for example, that 90% of the time the signal is not likely to fade more than, for example, 9.5 dB.[34] Then the link can be designed with sufficient margin to overcome this 9.5 dB attenuation, which although it occurs for only a small percentage of the time, nevertheless would be a significant performance point in the design of a wireless telecommunications system. When seeking to ensure satisfactory performance in such a case, there is no reason to take into consideration how often the fade levels are only 0 dB, 1 dB or 2 dB, or whether there are cases where multi-path effects actually increase the signal strength. Even if fade levels are expected to be lower than 3 or 4 dB for 50% of the time, the 9.5 dB attenuation problem is still one of the main obstacles to be overcome in providing a reliable link.

The propagation models that have been developed to predict "fade depth" in urban areas, and on which Motient relies, are designed for this type of analysis. That is, they are designed to ascertain whether there is a 50% to 100% chance that a wanted signal can be produced in any given case. A wanted signal is not itself harmed if signal attenuation, in the real world, is less than anticipated. An overly cautious assumption about too much path attenuation simply results in extra margin that makes the signal more robust.

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[34] Hess model, semi-urban environment, $P_s = 50\%$.

However, where a multi-billion dollar system (such as Inmarsat's) is up and operating, and the main concern is protecting the existing and future services from an unwanted, interfering signal, the assumptions that one makes about propagation effects are quite different. *In fact, they are practically the opposite.* In this case, while being conservative, one also needs to determine all of the different anticipated levels of path attenuation, and the statistical time period that each level is expected to occur. In other words, one cannot ignore the levels of path attenuation that are likely to occur less that 50% of the time, such as 0 dB or less, 1 dB or 2 dB, as one can do when designing a wanted signal. In fact, the probability of each of these low levels of attenuation occurring must drive the analysis. The victim system cannot focus on the occasional points in time when it might be assured of a large level of attenuation of the interfering signal -- *the victim has to focus on the times when the interfering signal will not be blocked because attenuation of the interfering signal is low or nonexistent and therefore interference levels are highest.*

Any unrealistic assumptions about the level of real world path attenuation on an interfering signal directly impacts the performance of the victim system. Particularly when considering the likely impact of Motient's proposed terrestrial service on Inmarsat's satellite service, the Commission needs to be mindful that any unrealistic assumptions about propagation would harm the primary user -- the Inmarsat satellite network. In other words, Inmarsat would pay the price if Motient's terrestrial system is given permission to operate based on mistaken guesses, or misapplication of empirical data, about the levels of path attenuation that might actually affect the interfering signals from the proposed Motient terrestrial transmitters.

For these reasons, it is critical that the Commission reject Motient's unfounded assertions in its Technical Appendix about "average" shielding between a terrestrial terminal and

the geostationary arc.[35] Motient appears to rely on data derived from the Hess model, but the Hess model does not calculate "average" attenuation. Rather, it specifically predicts what attenuation levels will *not* be exceeded in various environments (such as urban, suburban, etc.) for percentages ranging from 50% to 99% of the time. For example, it allows one to derive the expected *median* attenuation in a given environment (where there is a 50/50 chance that attenuation will or will not exceed a certain value).[36] It is a basic principle of statistics that "median" and "average" are different quantities. One cannot "assume" or extract averages based on information about median values.

As the Supplemental Technical Annex explains, real world measured data rebuts Motient's assumption that certain propagation effects will reliably attenuate the Motient terrestrial signals. Measured signal strength on the L-band signal from an Inmarsat satellite to a mobile user in a suburban environment has been reported in an ITU publication.[37] That data shows that, for large percentages of the measured time, the level of signal attenuation in that environment was quite small, and significant levels of attenuation occurred sporadically. Other measurements, depicted in Figure 3-1 in the Supplemental Technical Annex, show attenuation of 3-4 dB or less for 50% of the time measured, zero or less attenuation for 30% of the time

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35 *See* Motient Comments, Technical Appendix at 1, 4 ("studies have concluded that an average of 22.4 dB of attenuation of MSS signals is expected for outdoor use of an MSS mobile in urban areas") ("In suburban areas, where the average shielding between a user and the geostationary arc averages 16.9 dB . . . ."); *cf.* Supplemental Technical Annex at Section 3.2.

36 The Hess model *does not* predict attenuation levels that will not be exceeded for percentages less than 50%. For example, it does not allow one to determine for what percentage of time the attenuation will not exceed, say, 1 dB. However, the percentage of time that the expected levels of path attenuation are at or below 1 dB is critical in analyzing the potential for harm from the interfering Motient terrestrial signals. *See* Supplemental Technical Annex at Section 3.2.

37 *See* Supplemental Technical Annex at Section 2.